

This view down the canyon shows the crushing plant in the foreground, the conveyor passing the warehouse and shops building to the fine ore storage shed and the concentrator building. Beyond are the southern shore of the Great Salt Lake and a farming

area north of Tooele, which is down the canyon and around to the left. While the steep, narrow canyon created design problems, the gravity-based concentrator flow requires only five process pumps, creating significant savings in energy costs.

\$217 Millon Carr Fork Project Comes On Stream On Schedule And Near Budget

On August 31st—one day ahead of a schedule that had been set five years before—Anaconda Copper Company shipped the first concentrates from its \$217 million Carr Fork mine near Tooele, 25 miles southwest of Salt Lake City.

One of the very few underground base metal mines developed in the United States in the past decade, Carr Fork will produce between 41,000 and 50,000 tons annually of copper contained in concentrates.

Feed to the mill is ore grading 1.84 percent copper, along with "significant" quantities of molybdenum, gold and silver. The ore also carries a sizeable quantity of magnetite, of no

economic value at the moment. Research is being done, however, on the possibility of utilizing the magnetite for washing coal.

Start-up of the operation went relatively well, said Manager Arthur Ditto.

Ditto said it was anticipated that production levels would be near 1,000tpd by the end of October. He said the schedule calls for rated capacity to be achieved by the fourth quarter of 1980.

Rated capacity calls for 14,000tpd of ore, working three shifts a day for five days a week. An equal amount of ore will be hoisted daily on two shifts per day, five days a week. Milling capacity is 10,000tpd on a three-shift

basis, seven days a week.

The concentrator is located in a steep, narrow canyon. Although the location posed some design problems, engineers took advantage of gravity flow to such an extent that only five process pumps are required in the entire plant.

Concentrate is hauled nine miles by truck to the main line of the Union Pacific Railroad, then shipped to the Anaconda smelter at Anaconda, Montana for smelting. Blister copper produced at Anaconda is shipped to the company's electrolytic refinery at Great Falls, Montana.

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Carr Fork ...

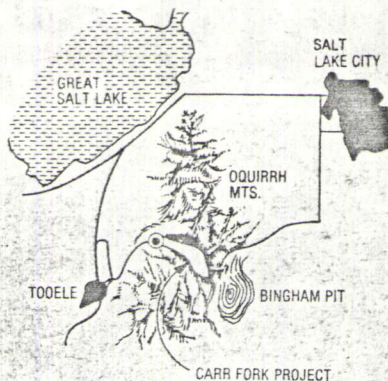
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Although start-up of the five-year project on schedule and near budget is considered a remarkable achievement, Ditto and his staff and crew, now totaling 720 persons, are having no time to rest on their laurels.

"1980 will be our most challenging year as we work to expand production" towards rated capacity, Ditto said. "There is and will be a terrific demand on the work force and supervisory personnel," he explained.

To date the work force, 80 percent inexperienced, has been concentrating on development work. It is now making the transition to production, developing and producing ore from 300,000-ton blocks via the conventional blasthole method, with some variations to come. (See below.)

Additional miners are being added and trained and by the time rated production is reached in about a year there will be a



planned 820 personnel on the Carr Fork payroll.

The Carr Fork Project is located in the Oquirrh Mountains on the northwest flank of the huge Bingham Canyon openpit mine of

Anaconda Copper Corporation, with the two companies having common property boundaries.

Anaconda's access to its Carr Fork operation is from the west side of the mountains, with a road from Tooele running northeasterly into Pine Canyon, where the Carr Fork concentrator, offices and other surface facilities are located.

NEW MINE—OLD DISTRICT

Although the Carr Fork mine is a completely new operation producing from new orebodies, the district is an old-time, large-scale producer. The new operation is producing from orebodies deeper and further to the east than previous production.

Anaconda, which acquired the Carr Fork property in 1948, has been active in the Bingham Mining District since 1914 when International Smelting & Refining Company, a subsidiary, built a custom smelter near Tooele.

To establish stable sources of ore and concentrates for its Tooele smelter, Anaconda acquired interests in various properties and companies in the district. By the mid-1930s, it held a substantial interest in the area west and northwest of the Bingham Canyon mine. Five of the companies in which Anaconda had interests subsequently consolidated to form National Tunnel & Mines Company, which developed the first underground copper mines in that part of the district.

To transport ore from the Utah-Delaware mine to the International concentrator and smelter in the rugged country, National Tunnel & Mines drove the 27,000-foot Elton tunnel. It began the project in 1937 and completed it in 1941. The company continued to operate through World War II, until 1947.

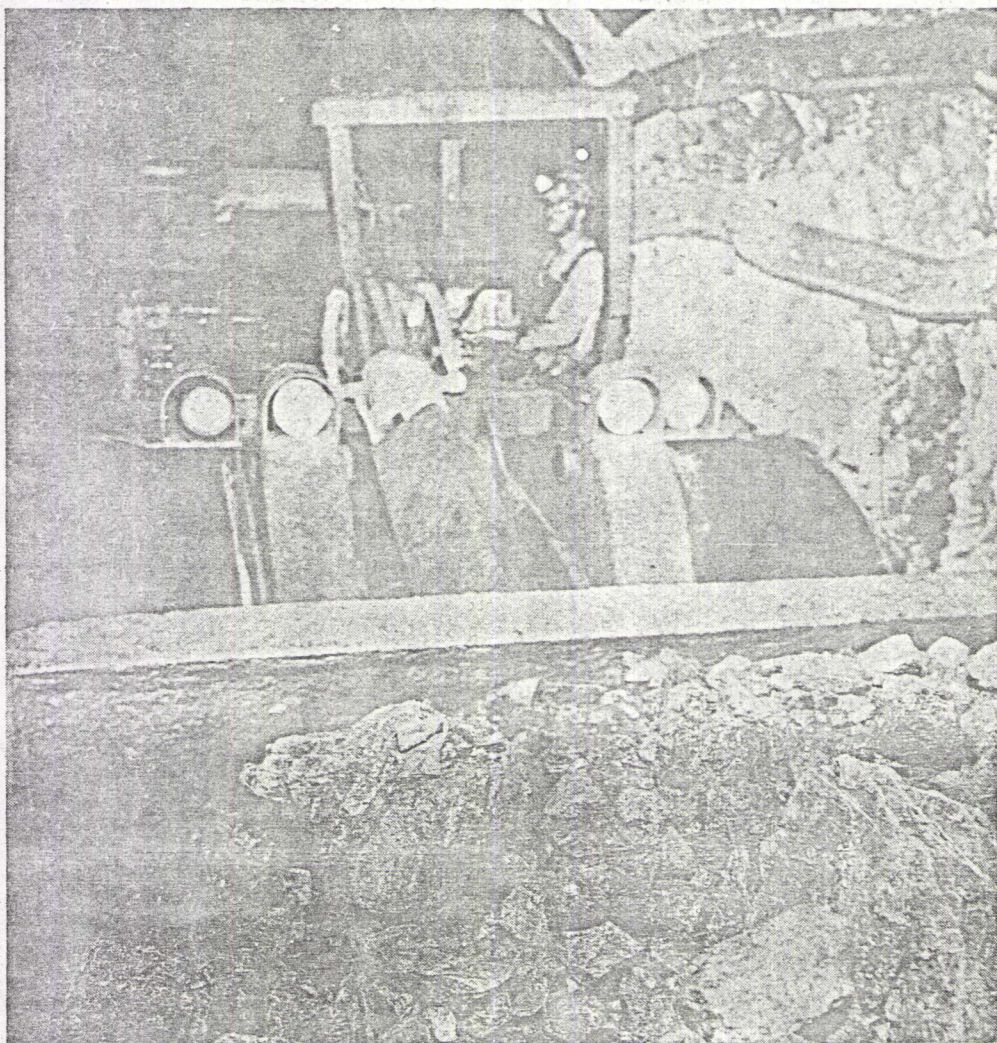
During 1948, Anaconda acquired all the land and assets of National Tunnel & Mines, including the Carr Fork claims. A 20-year exploration program on the properties led to an extensive core drilling program that began in 1969. By 1973, drillers had delineated the Yampa and Highland Boy orebodies that are the basis of the Carr Fork mine.

The Carr Fork deposits lie under the western flank of the Oquirrh Mountains at a depth of 2,000 to 6,000 feet. The ore is a skarn formed in two limestone units enclosed by quartzites, all of which are Pennsylvanian in age.

The orebodies have an average overall dimension of approximately 2,950 feet by 3,300 feet and show exceptional continuity, with few unmineralized zones within the presently defined boundaries. The two mineralized limestone beds range in thickness from about 80 to 250 feet.

Dips range from vertical to 20 degrees and the strike varies from east-west to northeast-southwest. Hangingwall and footwall rocks are generally unmineralized quartzites, with

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Puttin' Rock In The Box

At last! After five years of work and the expenditure of more than \$200 million, a front-end loader begins to recover the first of millions of tons of ore several thousand feet below the surface.

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the exception of some minor areas of copper mineralization in the hangingwall. The ore is moderately hard and tough, while the waste rock is hard, brittle and fractured.

A MODERNIZED OPERATION

To minimize per unit costs, the Carr Fork mine utilizes a variety of equipment that has been developed in recent years. Haggblunds loaders, five-car shuttle trains and two-boom Atlas Copco drill jumbos are used in development work. Rubber-tired LHDs are used for ore recovery.

The main haulage system, when in operation, will use two trains of 16-cubic-yard Asea cars. Each train contains 18 to 20 cars, powered by two General Electric 30-ton locomotives.

The trains can be controlled from either locomotive, with the second unit responding automatically to the operator's commands. The trains also can be radio-controlled by an operator at the loading chute. The system is built to U.S. railroad standards.

Conventional blasthole methods are being used for mining, but the company also plans to use Canadian Industries Ltd.'s patented "Vertical Crater Retreat" method.

"This method has been a fact of life for three years," Ditto explained. "It employs essentially the same procedures we had already anticipated using. Nothing different with respect to development, drilling, ore draw, and so on. It's simply a variation and it has the potential to eliminate some development work and also to use explosives more effectively. It has the potential to reduce blast damage throughout the mine and at the same time produce better fragmentation. It's a very significant development."

MINE USES FOUR SHAFTS

Four circular-concrete-lined shafts service the mine. Three shafts, the production, service and exhaust air shafts, were sunk from the surface. The fourth, a fresh air shaft, was collared near the end of the 6,000-foot Pine Canyon tunnel.

The production shaft was bottomed at 3,784 feet in late 1978 with crews from Anaconda and Peter Kiewit & Sons both contributing to the work. The service shaft was completed to a depth of 3,845 feet and was used to hoist waste as well as men and supplies until the production shaft became operational.

The internal fresh air shaft was bottomed at 3,511 feet. The Pine Canyon access tunnel, in which it is collared, will be used only for air intake and servicing the shaft.

Thyssen Mining & Construction Company sank the initial 2,493 feet of the 3,360-foot deep exhaust air shaft. The remaining approximately 850 feet will be done by Anaconda crews, which are now being mobilized. The bottom will connect with mine



Where Ore Reaches The Surface

The concrete structure encloses the headframe for the circular, concrete-lined, 19-foot-diameter production shaft that bottoms out 3,782 feet below the surface. To the right of and beyond it can be seen some of the structural steel for the headframe of the service shaft that goes approximately to the same depth. In the foreground, the conveyor that moves coarse ore to the crushing plant.

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workings at the 970 level, the bottom haulage level.

MILL WORKING WELL

Ditto said the new mill "is doing extremely well," coming on line with "no hitches whatever."

Anaconda engineers designed the flowsheet and Bechtel Corporation provided construction management. Concentrator Superintendent Jeff Butwell was with the project since it began.

Anaconda considers itself conservative when it comes to designing and building crushing plants and the company put together an extra husky plant at Carr Fork. Equipment includes Nordberg crushers, Tyler screens, Falk drives, Jeffrey belt conveyors and Koppers Hardinge grinding mills. Some equipment was obtained from other Anaconda operations and was rebuilt.

"HOME-GROWN" PERSONNEL

Because of the serious shortage of underground miners, not only in the Carr Fork area but throughout the West, Anaconda began a "head start" underground miner training program in the spring of 1977, more than two years ahead of the time when production was scheduled to begin. Persons accepted for training received four months of classes and practical instruction before going to work in the mine on development work.

The training program has been and is part of the Anaconda philosophy to use employees to construct facilities and develop the mine and then retain them as the operating staff. The company feels this is a good policy for many reasons, including loyalty, morale and continuity of personnel.

Although qualified "outsiders" who made application have been accepted for training and-or employment, most of the non-technical work force has been recruited from the surrounding area. Most of these people already have housing, family ties and consider the area as "home," factors that tend to keep employees working at Carr Fork and not pulling up stakes and moving away.

Anaconda started its first training class at Carr Fork in the spring of 1977. In August of that year, the first graduates received certificates in trackless mining procedures.

During early stages of development of the mine, contractors were employed. By late last year, as additional trainees graduated and joined the work force, nearly all the miners were Anaconda employees, a gradual transition completed during 1979.

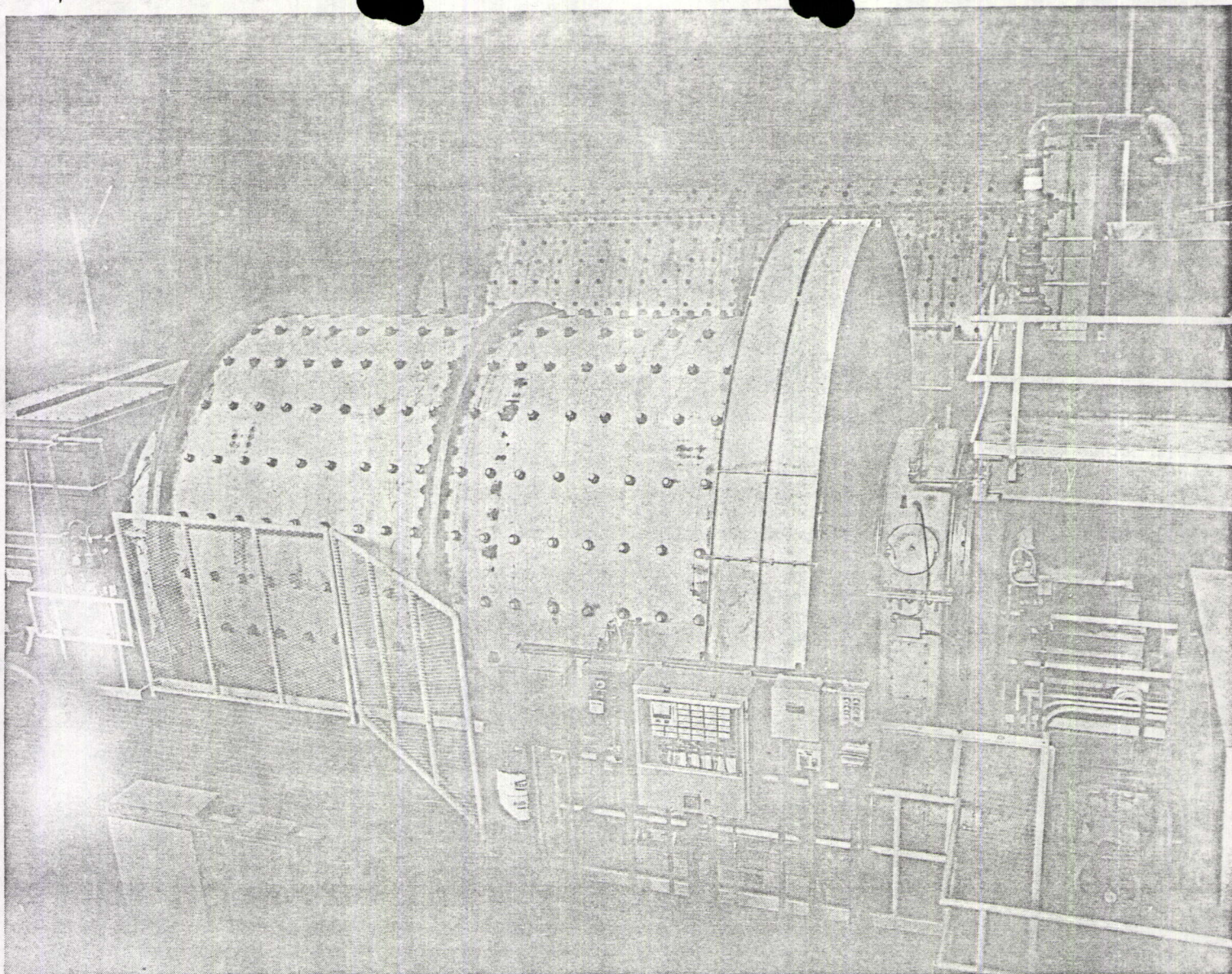
Since a company study indicated it could not expect to recruit miners from other mining communities, hiring and training of local residents is now standard practice. Since few of these new employees have underground mining experience, training from scratch is an integral part of the program.

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A Long View Down Pine Canyon

A vantage point from atop of the production shaft headframe enclosure provides an excellent view down the canyon and of the surface facilities. Since the photo was taken just before production began, there was yet no ore in the coarse ore stockpile area in the foreground. Structures on down the canyon are the crushing plant, warehouse and shop building, fine ore storage pile shed and the concentrator.



Rod And Ball Mill

Plenty of grinding muscle is provided by the Koppers Hardinge mills shown here, with a 14x20-foot rod mill in the foreground and a 16½x29-foot ball mill. There also are two 9½x15-foot grind ball

mills. Milling capacity is 10,000 tons per day on a three-shift basis. The plant is operated seven days a week.

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Trainees for underground mining are carefully screened. On the average, about eight new trainees are selected each month and are paid from the start of training. Training includes four major topics: drilling, blasting, ground support and mucking. As part of the orientation, sessions are held on mine safety and first aid. After graduating, they are usually paid the going rate for third-class miners.

TRY FOR BETTER TIMING

At the time Anaconda management was debating in 1974 whether to proceed with the Carr Fork Project and its massive capital investment, the copper market was beginning to break, starting its long downhill slide. In

addition, Anaconda at the time, prior to its merger into Atlantic-Richfield, was not exactly burdened with excess cash.

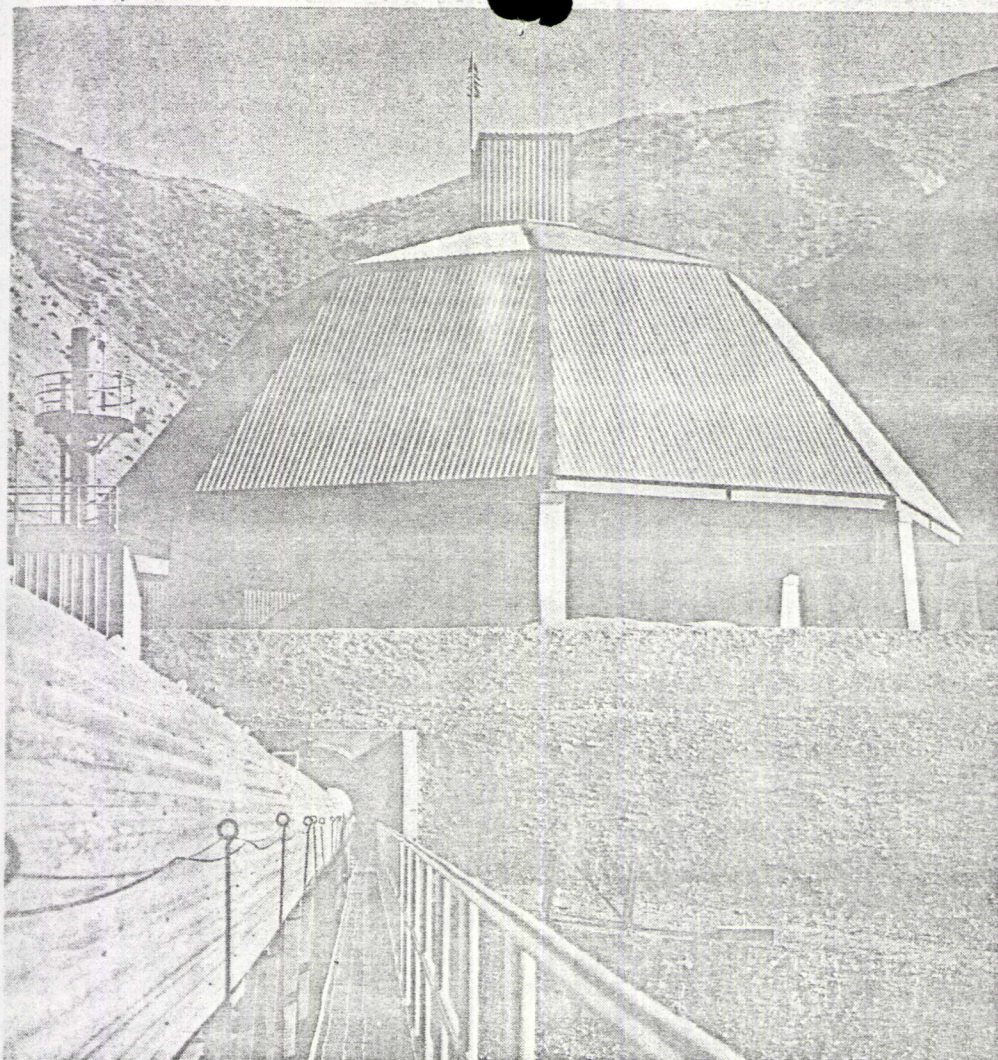
In discussing that dilemma, Ditto said, "Perhaps the most important issue relates to the cost of production, as opposed to speculating on what the future market price might be. The first premise is that there will continue to be a copper business. If this is accepted as valid, analysis must then shift to the position of the company as a producer in the copper industry. If it is a low-cost producer and if there continues to be a copper business, the company will survive.

"It became apparent early in the company's analysis that the Carr Fork orebody could be a low-cost producer," Ditto said. "This provided a substantial portion of the

encouragement or assurance to commit the tremendous amount of money required.

"On the other side," he continued, "the consensus at the time the appropriation was committed—and management still feels strongly about this as regards to long-range planning—was that the price-cost squeeze that the copper industry is now in will change. There will be a profit margin in this business in the 1980s. Anaconda is optimistic that Carr Fork can do well not only because it is a low-cost producer but also because the mine will be coming on stream during a period of higher demand than the industry has been looking at recently.

"By putting this project in now, the company can start up during a period of high demand, instead of being involved in a period



Fine Ore Storage Shed

An interesting pattern is formed by the steep panels of the roof covering the fine ore stockpile to protect it from the heavy snows that sometimes fall in the region. The covered conveyor moves the ore on demand to the concentrator building, behind the photographer.

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of capital expenditure during a time when it can generate revenue.

"This is one of the problems most mining companies face," Ditto pointed out. "The only time they can generate enough cash to provide the funds for capital expansion is during the times of higher product prices. By the time they get the project going, the demand is gone, and they are trying to recover the investment at low prices for the product. Anaconda hopes in this case that it will be in the reverse position," he concluded.

At this point—some two months after production began—Carr Fork is in that position, with copper prices fluctuating rapidly between 90 cents and \$1.10 or more a pound, gold prices in the \$400 an ounce range and silver several times higher than it was a few months ago. With the shaky economy, however, there is no telling where these

various prices will be a year from now—when Carr Fork is scheduled to reach designed production levels.

In the meantime, Carr Fork is making a major contribution to the economy of the area and the state as a whole, with a major payroll, large-scale purchases of goods and services and sizeable tax contributions to many levels of government. Hopefully, Anaconda also will share in the proceeds.

Of Mines And Men

Robert A. Malone of McGill has been appointed manager of safety and security for Kennecott Minerals Company. Malone, 27, had been safety and environmental control director for the Nevada Mines Division since 1978.

He has a bachelor's degree in metallurgical

engineering from the University of Texas at El Paso. He joined the Nevada operations after graduation in 1974 as a metallurgical engineer and became supplemental control system engineer in 1975 and safety and security supervisor in 1976.

Chevron Shale Oil Company, a subsidiary of Standard Oil Shale of California, has been drilling core test holes on its property near DeBeque and Grand Valley in Colorado.

Norman Angell, senior legal representative of the company, told the Garfield County Commission that the company has been drilling since June. "We won't have results from the core test before the snow falls."

"Development will depend on what financial incentive the government can come up with. We are opposed to the \$3 a barrel tax credit. The federal government can come up with better incentives at the front end," Angell claims.

He said the project is in the beginning stages and told the commissioners the company has not set a schedule or decided on which technique it will use, how much it will develop or how many workers will be needed. Angell said he believes those decisions would be made this year.

E. T. Carlson has been named vice president and R. G. Bryant Jr. has been appointed project manager of Freeport Gold Company, a subsidiary of Freeport Minerals Company.

Freeport Gold is the operator of a 70-percent-owned joint venture with FMC Corporation in Nevada where drilling has proven up reserves of more than five million tons of mineralization averaging 0.3 troy ounces of gold per ton.

Carlson will undertake the responsibility for process design and Bryant for the overall engineering, design and construction of this possible \$70 million project in Jerrett Canyon north of Elko.

Carlson's experience with Freeport since joining in 1940 has covered both the chemical engineering and research and development areas. He was operations manager for the Freeport chemical division from 1966 to 1970, vice president of the Freeport research and development unit from 1970 to 1976 and vice president of Freeport Queensland Nickel Inc., a subsidiary, from 1972 to 1976 when he was named director of research and development for the parent company.

Bryant joined Freeport in 1949 as a mechanical engineer and has held several supervisory positions, notably superintendent of maintenance at the company's Grand Isle sulphur mine in the Gulf of Mexico, project engineer and manager of engineering.



E. T. Carlson